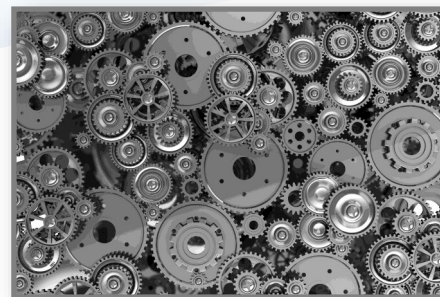


# MET-L-FLO INC.



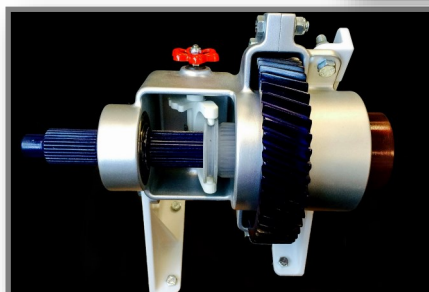
At Met-L-Flo, Inc. we have been asked on more than one occasion about our unique name.

"Wait, don't you do plastics?" Yes, we work in plastic and metal. What you may not know is Met-L-Flo Engineering was founded in 1969 as a consulting firm for the metal forging industry. Carl Dekker, our current President, introduced Additive Manufacturing in 1991 and the services we offered exploded. The consulting side of the business branched off and Met-L-Flo, the service bureau, was born.

Over the years our service offerings have continued to grow. Today we create parts in a wide variety of processes such as Additive (3D Printing) in SLA, SLS, FDM, Direct Metal and Polyjet. We also cast in urethanes, elastomers, silicones, and metals. Met-L-Flo offers Rotational Molding/Casting, Fiber Reinforced Plastics, Composites, and Vacuum/Thermo Forming parts as well. Many of our processes perfectly bridge the gap between prototyping and production. We offer Low Volume Injection Molding and Bridge Tooling in a wide variety of materials—putting end use product in your hands well before production parts are available.

In addition to our many ways of manufacturing products, we are expert finishers at Met-L-Flo. We can accommodate the entire spectrum of finish levels; from a simple fit and function analysis part, to a marketing ready piece. Secondary Machining is also available when required.

Our constant quest to exceed client's expectations motivates our Research and Development department to answer the questions yet to be asked. Met-L-Flo looks forward to partnering with you to conquer your challenges with our solutions.



# ENGINEERING



Does your program require design services?  
Is your design team stretched beyond capacity?  
Are you an inventor with a product idea but no way to take it to market?

Met-L-Flo, Inc. will work with you to model nearly any static or dynamic concept through our comprehensive approach:

## DISCOVERY

We research the needs of our clients to foster product specifications that will drive your development activities. Met-L-Flo, Inc. provides you with

## ANALYSIS

We offer a collection of computational evaluations to help you make informed decisions about the manufacturing of your product. We analyze your data with a given set of anticipated parameters to provide you refined solutions to meet such requirements as:

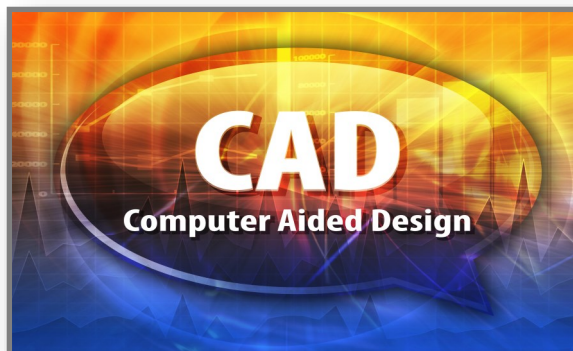
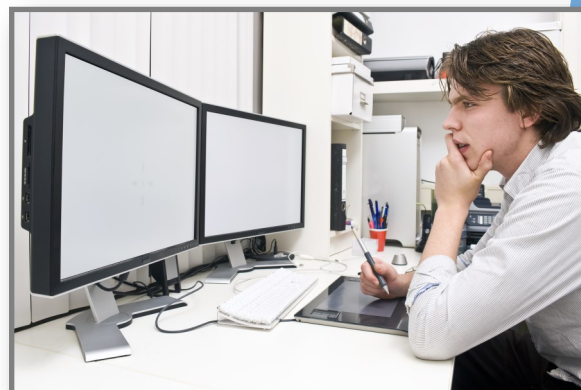
- ◆ Computational Fluid Dynamics (CFD)
- ◆ Finite Element Analysis (FEA)
- ◆ Structural
- ◆ Manufacturability
- ◆ Stress
- ◆ Deflection
- ◆ Fatigue
- ◆ Moodle
- ◆ Thermal

## OPTIMIZATION

- ◆ Product Integration
- ◆ Prototyping/Low Volume Production
- ◆ Testing

## INTEGRATION

- ◆ Process and equipment layout
- ◆ Fixture design
- ◆ Material handling
- ◆ Product launch support



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# INSPECTION & METROLOGY

## QUALITY IS INTENTIONAL

Met-L-Flo, Inc. is committed to providing our clients with the quality parts they expect. We customize the inspection of programs to fit the most stringent of requirements to the most basic fit checks to satisfy your needs.

## CONTACT AND NON-CONTACT MEASUREMENT

Measuring components via specific point contact or multi-point contact enables options for each unique application. Your desired output is the determining factor. From complex to simple, Met-L-Flo, Inc. fulfills your inspection and data capture requirements.

## SCANNING/REVERSE ENGINEERING

Scanning technologies can range from specific point data, computer tomography, all the way to full mega pixel point cloud data sets. The scanning results can be used for best fit or datum referenced inspection data sets including internal data confirmation and validation, or data recreation.

## MODEL BASED DATA (MBD) & DIGITAL PRODUCT DEFINITION (DPD)

- ♦ Verification of data translation
- ♦ Full D6-51991 Approval
- ♦ FAI Reports

## INSPECTION REPORTS

- ♦ 9102 reports
- ♦ Three point inspection
- ♦ Go/No-Go gauges and fixtures
- ♦ Acceptable Quality Level (AQL)



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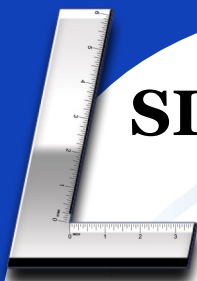


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# SLA—STEREOLITHOGRAPHY

Stereolithography uses a laser to solidify a liquid photopolymer resin building parts layer by layer. SLA is a great choice for complex geometries because of the precision to which it builds and the ability to apply a multitude of finishes. Met-L-Flo, Inc. uses our large capacity SLA systems, as well as our expertise in model finishing, to produce quality prototypes in an accelerated timeframe.

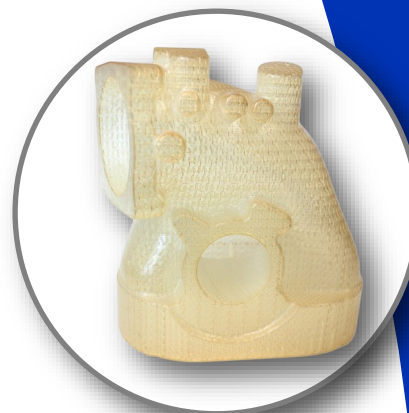
## LARGE CAPACITY WITH EXPERT FINISHING THAT GIVES PRODUCTION QUALITY MODELS



With our bank of SLA systems we are able to offer a variety of materials to accommodate the requirements for any program with precision and accuracy. Met-L-Flo has the capacity to build around the clock and produce your parts in materials simulating ABS, Polypropylene, Polycarbonate or a clear resin.

SLA is a perfect fit for prototypes in any industry...

automotive, consumer appliance, aerospace, medical devices, electronic housings, etc. Met-L-Flo's expert finishers also make SLA a wonderful medium for your marketing needs. We can handle full model photo shoot pieces to focus group samples and everything in-between.



### Benefits/Advantages:

- ♦ Fast quote
- ♦ Fast turnaround
- ♦ Master finishing
- ♦ Multiple finishes available
- ♦ Material characteristics of thermoplastics

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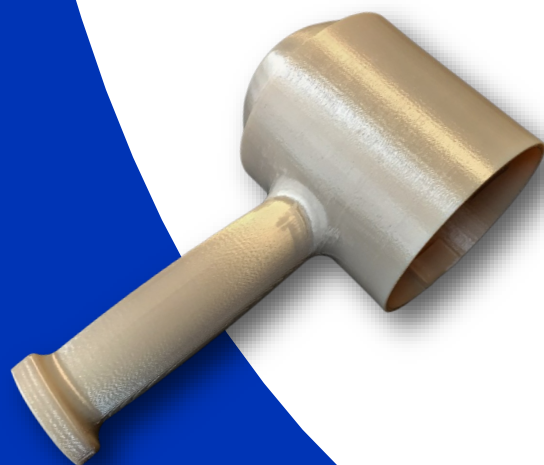
# FDM—FUSED DEPOSITION MODELING

The FDM process heats and extrudes a thin filament of thermoplastic to form parts layer by layer. The heat is used to fuse the layers together giving the parts increased structural integrity. FDM is a great way to 3D Print complex parts requiring material properties for high performance testing as well as final usage. We have a wide variety of FDM



## Benefits/Advantages:

- ♦ Fast quote
- ♦ Fast turnaround
- ♦ Real world thermoplastics
- ♦ Heat resistant



## Multiple Applications:

- ♦ High heat environments
- ♦ High stress environments
- ♦ Chemical environments
- ♦ End use parts
- ♦ Wind tunnel models
- ♦ Jigs and fixtures

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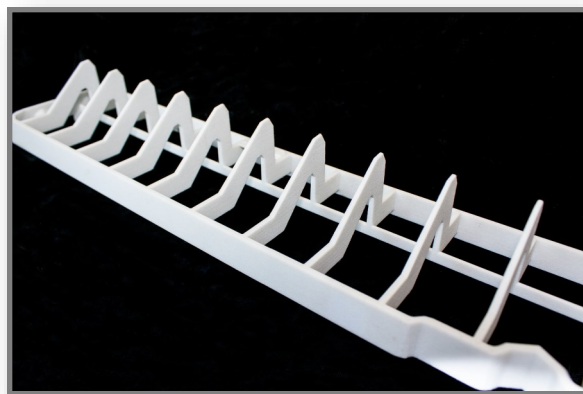


# SLS—SELECTIVE LASER SINTERING

Need a prototype that allows for functional testing, or a sample tank to withstand fuel storage? SLS is a great choice. The Selective Laser Sintering process melts a powder resin with a laser to build parts layer by layer. Multiple nylon powder options allow the durability, flexibility and functionality of the SLS process to really shine. SLS is also a great solution for hollow parts. Unlike other additive processes, SLS parts build support free. The powder resin becomes a natural support which is simply shaken out of the interior. Met-L-Flo, Inc. can then coat the interior to create useable tanks and other containers. SLS parts perform well in real world testing, including FEA, heat and chemical resistance evaluations.

## REAL WORLD MATERIALS THAT CAN BE USED FOR FUNCTIONAL TESTING

SLS allows you to produce end use parts, which is why this process is the perfect choice for several Additive Manufacturing applications. We have a wide range of finishes, coatings and materials available.



### Benefits/Advantages:

- ♦ Fast quote
- ♦ Fast turnaround
- ♦ Multiple finishes available
- ♦ Special additive coating for fuel tank applications
- ♦ Ideal for snap fits, living hinges, or high heat applications
- ♦ Multiple filled and unfilled nylon materials available



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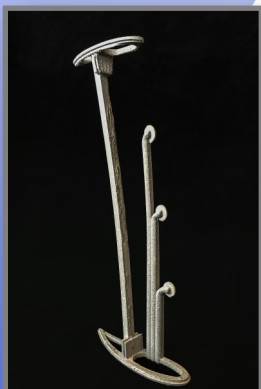




# DIRECT METALS

When you require complex metal parts quickly, traditional methods often fall short. At Met-L-Flo, Inc. we understand the importance of speed and accuracy. To address this need, we offer Direct Metal part production.

## DIRECT METAL PRODUCES COMPLEX METAL PARTS FAST



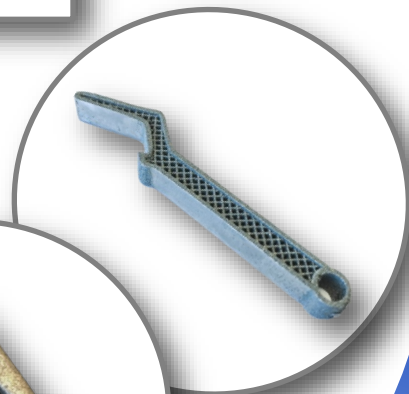
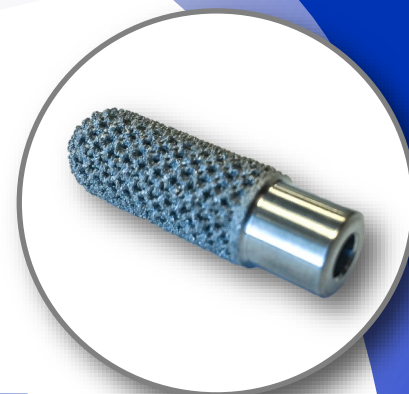
Direct manufacturing via laser sintering of metal alloys creates the ability to produce practically any shape you can imagine straight from a CAD file. When your part is too complex for conventional machining or would require costly, time consuming set ups, Direct Metal is an excellent solution.

### Benefits/Advantages:

- ◆ Parts delivered in days
- ◆ Conventional post processing technologies available
- ◆ Freeform designs produced easily
- ◆ Wide range of material options

### MATERIALS

- ◆ Stainless Steel
- ◆ Aluminum
- ◆ Cobalt Chrome
- ◆ Maraging Steel
- ◆ Inconel
- ◆ Titanium



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# MACHINING

Met-L-Flo, Inc.'s quick turn machining process is preferred when you need specific material specifications, high precision accuracy, and production grade finishes.

## OUR MACHINING PROCESSES ARE PERFECT FOR:

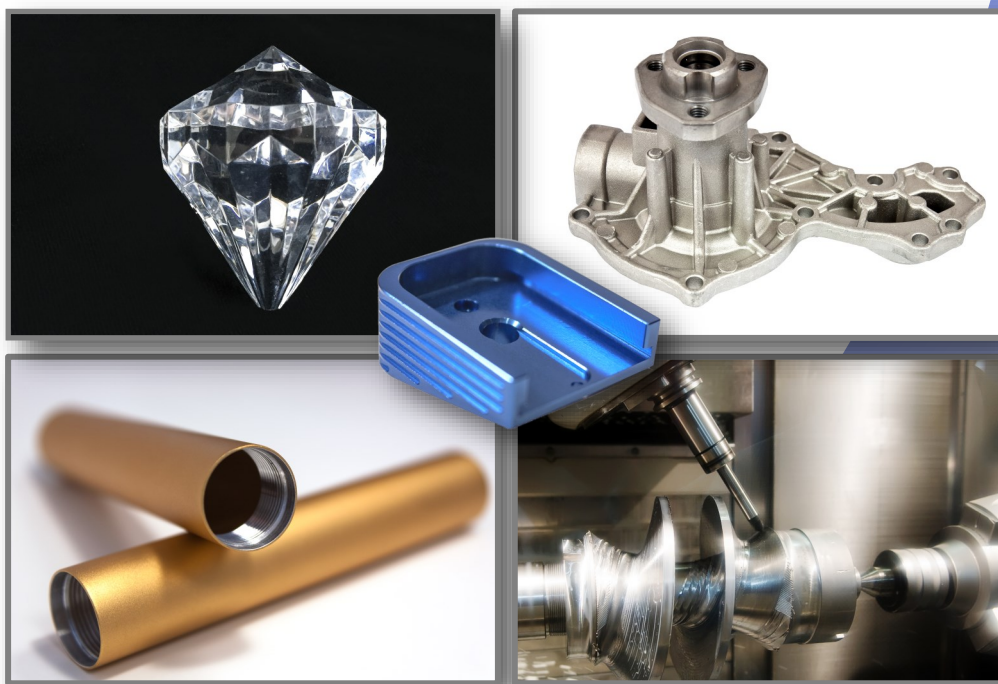
- ◆ Components outside the Additive Technologies realm
- ◆ Parts to fully validate your design with actual materials before spending time and money having production or injection tools cut

## We machine parts in a wide variety of materials:

- ◆ Titanium
- ◆ Stainless Steel
- ◆ Aluminum
- ◆ Brass
- ◆ Glass filled materials
- ◆ Nylon
- ◆ Delrin
- ◆ Ultem
- ◆ Polycarb
- ◆ Acrylic
- ◆ PC/ABS
- ◆ ABS
- ◆ Ren Shape (LDF, MDF, HDF)
- ◆ Foam
- ◆ And others

## Benefits/Advantages:

- ◆ Fast quote
- ◆ Fast turnaround
- ◆ Precise tolerances
- ◆ Milling & turning applications
- ◆ Multiple finishes available (Anodizing, Optically Clear, etc.)



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# FINISHES FOR ADDITIVE

Met-L-Flo, Inc. offers a variety of finishes, from a *basic*, fit and function surface, to a *custom* painted, metalized, textured, tinted or water clear surface.

## **FINISH OPTIONS FOR ADDITIVE (SLA, SLS, FDM, DMLS, POLYJET):**

**BASIC FINISH** – Supports removed and lightly sanded exterior

**APPLICATIONS:** Form, fit, and function

**BASIC PLUS** – Uniform exterior surface

**APPLICATIONS:** Design review

**MOLD READY** – Smooth visual, primed A surface

**APPLICATIONS:** Patterns for molding, parts for painting, plating, or print transfers

**PREMIUM** – Smooth interior and exterior, and documented specifications

**APPLICATIONS:** Functional end use components

**PHOTO** – Entire part will be polished (water clear/transparent when applicable)

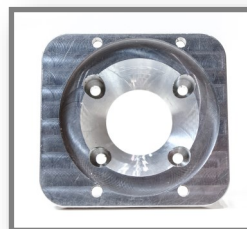
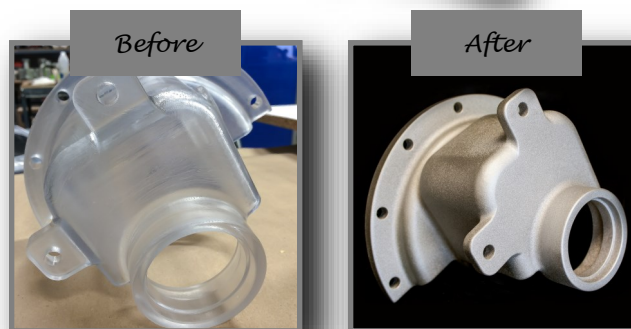
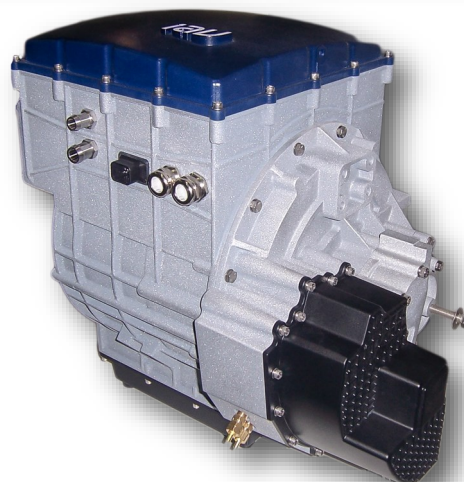
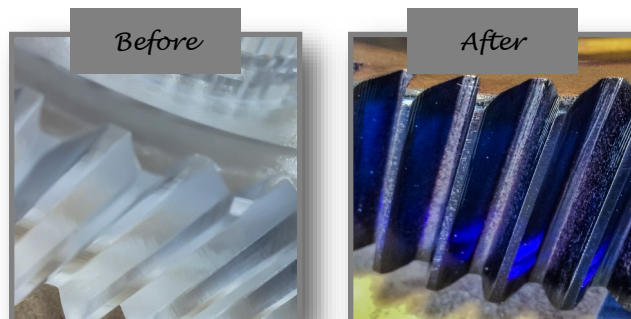
**APPLICATIONS:** Lenses, transparent covers for monitoring or training models, lighting studies, and preproduction samples

**CUSTOM** – Used to create production-like parts, with the ability to simulate virtually any material surface, as well as a wide variety of special requests

**APPLICATIONS:** focus groups, trade shows, and marketing campaigns

## **SECONDARY PROCESSES**

Machining, Inspections, Heat-treating, Vacuum plating, Radiographs, Electroplating, Labels, Decals, and many more.



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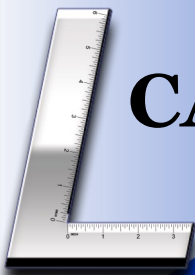
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# CASTINGS

Our tools, whether produced traditionally or additively, are cost and time efficient solutions when production like parts are needed quickly. We can simulate nearly all production material properties.

With over 25 years of casting experience we have the knowledge and expertise to produce parts of virtually any geometry or size with tight tolerances. We also manufacture over-molded parts and castings with inserts.

## **We offer a wide range of materials:**

- ♦ Urethanes
- ♦ Silicones
- ♦ Elastomers

## **Benefits/Advantages:**

- ♦ Quick turnaround
- ♦ Production material properties
- ♦ Multiple finishes
- ♦ 20-40 parts per tool
- ♦ Show ready parts
- ♦ Castings in all durometers



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# ROTATIONAL MOLDING/CASTING

The ability to create hollow prototypes is essential for certain products, such as bottles, tanks, bladders, tubes and more. Met-L-Flo, Inc. answers that need with Rotational Molding/Casting. This unique process allows for a variety of geometries and applications including over molding inserts.

Met-L-Flo has the extensive experience with quick turn hollow castings to hold tight tolerances.

## Benefits/Advantages:

- ♦ Quick tool production
- ♦ Customized durometers
- ♦ Consistent exterior surface finish
- ♦ 20 to 40 parts per tool
- ♦ Customized color matching
- ♦ Simulates Blow Molding



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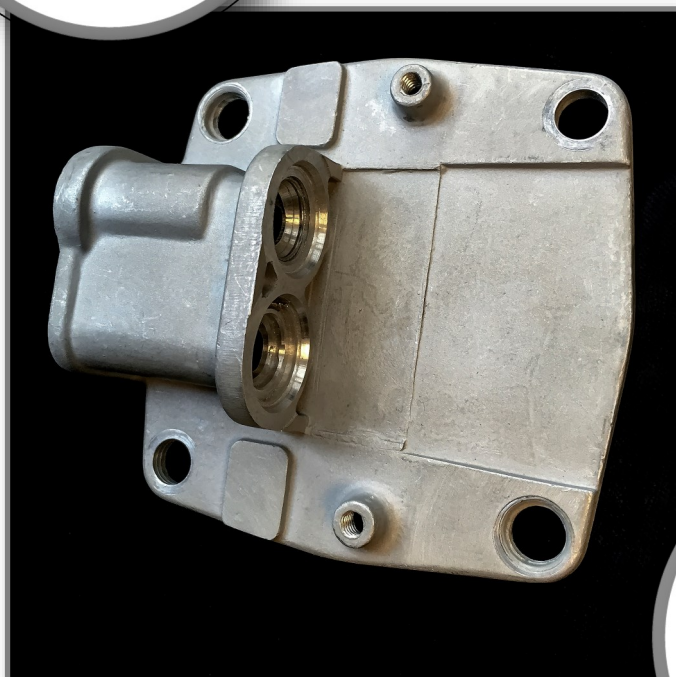


# METAL CASTINGS

When you need short-run or prototype Metal Castings and do not want to invest in production tooling, Met-L-Flo, Inc. is your perfect partner. We have decades of experience in Investment, Rubber Plaster and Sand Castings. With our advanced technologies we can quickly transform your design from CAD to part fast.

## FROM DESIGN TO PART IN AN ACCELERATED TIMEFRAME

Our Metal Castings offer an accelerated first article inspection turnaround time. By utilizing the latest in Additive Technologies, we are able to produce casting tools in half the time compared to traditional methods. We can even capture complex geometries and thin-walled parts that conventionally would be too difficult or nearly impossible to produce. When you are ready to move into production, our tools can also handle those larger volumes.



### Benefits/Advantages:

- ♦ Fast quote
- ♦ Fast turnaround
- ♦ 1st Article in hand fast
- ♦ Precise tolerances
- ♦ Stronger, lighter castings
- ♦ Minimal post-machining
- ♦ Multiple finishes available
- ♦ Production capacity available



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# COMPOSITES AND FIBER REINFORCED PLASTICS

High performance products require high performance materials. When you have specific material testing requirements, fiber reinforcement adds strength and durability to meet your needs. Met-L-Flo, Inc. has perfected the advancement of the materials and building technologies so you can concentrate on the advancement of your designs.

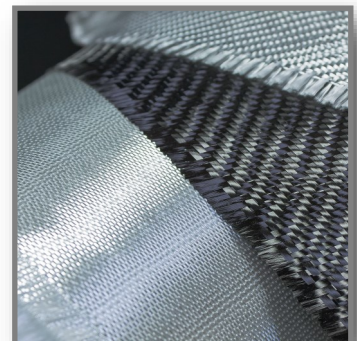
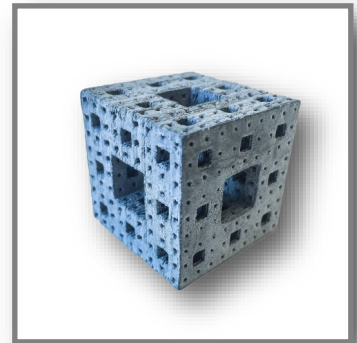
## FRP—FIBER REINFORCED PLASTICS

Using carbon, Kevlar™, or glass fiber we produce parts that perform like never before. Fiber reinforcement is perfect for high heat and/or high pressure hose and other under the hood type applications. Parts that need to withstand harsh, high stress environments or heavy loads, no longer need to create high stress for their engineers. Met-L-Flo's FRP is the solution.

This process is ideally suited for geometries with large, flat, or sweeping curved surfaces. Our skilled craftsman can install complex features and additional components where necessary. Typical applications are automotive, large over the road, agricultural, earth moving, and construction equipment.

### Benefits/Advantages:

- ◆ Performance parts are delivered in days
- ◆ Class A surface finishes obtainable
- ◆ Freeform designs can be produced easily
- ◆ Integrated components added where desired
- ◆ Wide range of material options
- ◆ Customizable properties
- ◆ Withstands vacuum and pressure at elevated temperatures
- ◆ High heat resistance
- ◆ Tooling at a fraction of conventional costs and lead time



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# FINISHES FOR CASTING

Met-L-Flo, Inc. offers a variety of finishes, from a *basic*, fit and function surface, to a *custom* painted, metalized, textured, tinted or water clear surface.



## **FINISH OPTIONS FOR CASTINGS:**

**BASIC** – Gates, vents, and flash removed

**APPLICATIONS:** Form, fit, and function

**PAINT READY** – Part will be completely finished with a smooth primed and/or painted A surface

**APPLICATIONS:** Parts for customer painting, plating, or print transfers

**PREMIUM** – Finished smooth with clean features and surfaces, and documented specifications

**APPLICATIONS:** Functional end use components

**PHOTO** – Entire part will be polished (water clear/transparent when applicable)

**APPLICATIONS:** Lenses, transparent covers for monitoring or training models, lighting studies and preproduction samples

**CUSTOM** – Used to create production-like parts, with the ability to simulate virtually any material surface, as well as a wide variety of special requests

**APPLICATIONS:** Focus groups, trade shows, and marketing campaigns

## **SECONDARY PROCESSES**

Machining, Inspections, Heat treating, Vacuum plating, Radiographs, Electroplating, Labels, Decals, and many more.



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# LOW-VOLUME INJECTION MOLDING (BRIDGE TOOLING)

At Met-L-Flo, Inc. we understand the importance of actual materials and larger quantities for pilot builds, testing and bridging the production gap. We developed our Bridge Tooling program to produce complex parts in record time. Our process can handle most designs without altering your geometry.

## BRIDGE TOOLING GETS YOUR PRODUCT TO MARKET FAST

Our Bridge Tooling program uses standard mold base frames with customized core and cavity inserts to manufacture your design. We use our quick turn Machining and EDM processes to produce full detail core and cavity inserts, delivering the production quality surfaces and tolerances you require.

### Benefits/Advantages:

- ♦ Fast quote
- ♦ 1st Article in hand fast
- ♦ Optically clear finishes, high polished & textured surfaces
- ♦ Tool life up to 50,000 shots
- ♦ Wide range of material options
- ♦ Simple solutions for complex parts
- ♦ Insert-molding
- ♦ Over-molding
- ♦ Hand loaded inserts to increase speed and cut cost



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# THERMOFORMING/ VACUUM FORMING

Met-L-Flo, Inc. uses the process of thermoforming to produce a multitude of large and small shallow surfaced plastic parts. During thermoforming, a flat sheet of material is heated to a pliable temperature and pressurized against a tool. Both pressure and suction can be used in the process, explaining the common industry terms of Vacuum forming (vacforming) and pressure forming. Both vacuum formed and pressure formed parts are very prominent in our daily lives. Some of the most common applications are plastic packaging, dash boards, food transport containers, point of purchase displays and interior aircraft panels.

## WHY CHOOSE THERMOFORMING?

It's fast and cost effective. Vacforming and pressure forming tooling is easier and faster to create than production tooling. Reduction in tooling time equals final parts in your hands rapidly. These quick, less expensive tools also allow for design modification. The thermoforming process is an ideal method for design testing and marketing campaigns of products well before production parts are finalized.

### Benefits/Advantages:

- ♦ Cost effective
- ♦ Faster than production
- ♦ Design flexibility
- ♦ Variety of materials including grades
- ♦ Molded in texture
- ♦ Allows for undercuts



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